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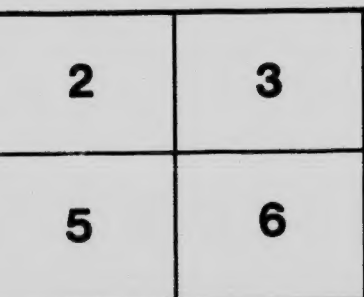
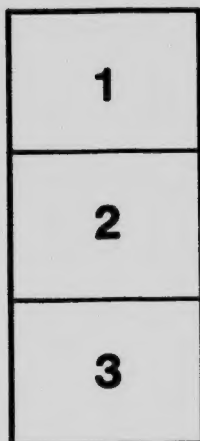
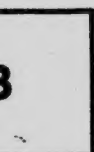
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CAUSES OF VARIATION IN THE PERCENTAGE OF FAT IN HAND SEPARATOR CREAM

DEPARTMENT OF AGRICULTURE,
OFFICE OF THE DAIRY AND COLD STORAGE COMMISSIONER,
OTTAWA, August 16, 1915.

Patrons of cream gathering creameries frequently complain of the variations which occur in the percentage of fat as revealed by the test of the cream delivered from time to time. These variations have given rise to more or less dissatisfaction on the part of the patrons, and have been the cause of unnecessary friction between them and the managers of creameries.

A series of tests and experiments bearing on this point have just been completed at the Finch Dairy Station and the results are published herein with a view of explaining how such variations may be due to irregularities in the running of the cream separators.

In nearly all separators the proportion of cream is regulated by what is termed a "cream screw." When this screw or plug is turned towards the centre of the bowl, it contracts the cream line and gives a richer or higher testing cream. Turning it outwards widens the cream line and, therefore, allows a larger proportion of the skim-milk to pass out with the fat and thus gives a thinner or lower testing cream.

Considering the question of separation from a purely mechanical standpoint, one would naturally come to the conclusion that once the cream screw is set at any desired point, the separator would always deliver cream containing the same percentage of fat. We must, however, consider several other factors which very materially affect the working of a cream separator. The following are the most important ones:—

(1) *The Percentage of Fat in the Milk.*—Milk from a single herd will vary in fat content from day to day, sometimes to quite an extent. This variation will affect the per cent fat in the cream. For instance, in milk testing 4 per cent, there are four pounds of fat in 100 pounds of milk; in milk testing 3 per cent fat, there are only three pounds of fat in 100 pounds of milk. If 100 pounds of each lot of milk is run through a separator under exactly the same conditions as to time, speed, temperature, etc., there will be practically the same number of pounds of cream, but there would be practically one pound of fat more in the cream from the 4 per cent milk, which would give a correspondingly higher testing cream than would be taken from the 3 per cent milk.

(2) *Temperature of the Milk.*—Milk at 70 degrees temperature is thicker or more viscous than the same milk would be if heated to 95 degrees; it will therefore not run through the separator as fast, the cream line will be narrower and the cream will test higher from milk at 70 degrees than from the same lot of milk separated at 95 degrees.

(3) *Flow of Milk into Separator.*—The milk inlet on all separators is made to feed the separator to its full capacity. If the flow of milk is partly shut off, the cream line will be narrower and a richer or higher testing cream will be the result.

(4) *Speed of the Separator.*—All hand separators are manufactured to run at a certain speed and they will do the best work at this speed, which is usually indicated on the handle of the separator. If the speed is increased, the centrifugal pressure is increased, which has the effect of condensing the cream, so that a smaller quantity of richer cream is the result.

To ascertain to what extent the above conditions would affect the percentage of fat in the cream, and to secure some accurate data on the subject, the following experiments were carried out, using a 400-pound hand separator.

In table I is given the results of separating the milk at different temperatures, all other conditions being the same. One run was made from the same milk at each temperature stated on three different days. The figures given are the average of the three days. Mixed night's and morning's milk from the same patrons was used each day.

TABLE I.—Separating at Different Temperatures.

Per Cent Fat in Milk.	Temp. of Milk at Separating.	Lbs. Cream per 100 lbs. Milk.	Per Cent Fat in Cream.	Per Cent Fat in Skim-milk.
		Lbs. Oz.		
3.57	70 degrees	8 0	44.2	.040
3.57	75 "	8 14	40.0	.033
3.57	80 "	10 0	35.5	.021
3.57	85 "	10 11	33.1	.028
3.57	90 "	11 2	32.0	.017
3.57	95 "	12 2	29.3	.021

Here we find a variation of 14.9 per cent fat in the test of the cream with all the conditions the same, except the temperature of the milk. The pounds of cream per one hundred pounds of milk increases as the temperature of the milk is raised and it must also be noted that the percentage of fat in the skim-milk increases as the temperature of the milk is lowered.

Table II shows the effect of changing the speed of the separator. The figures given are the average of three runs at each speed on three different days.

TABLE II.—Variation in the Speed of the Separator.

Per Cent Fat in Milk.	Temperature of Milk.	Speed turned per minute.	Lbs. Cream per 100 Lbs. Milk.	Per Cent Fat in Cream.	Per Cent Fat in Skim-milk.
			Lbs. Oz.		
3.63	95 deg.	35	9 14	36.6	.018
3.63	95 "	*60	12 0	30.1	.017
3.63	95 "	55	15 7	23.4	.023
3.63	95 "	50	18 14	19.2	.027

*Correct speed.

A metronome was used to count the turns of the handle, so that the speed of the separator was absolutely the same during the whole run. It was found extremely difficult to turn the separator at a uniform speed throughout an entire run, and unless the operator has a reliable indicator, there is likely to be a considerable variation in the speed of the separator. The writer is of the opinion that the speed of the separator has probably more to do with the variations in the cream tests than any other condition.

Five turns per minute under proper speed made 6.7 per cent difference in the test, and ten turns too slow made a difference of 10.9 per cent. The difference in the test between five turns too fast and ten turns too slow was 17.4 per cent, the percentage being only a little over half in one case what it was in the other.

Turning the separator too slow also causes a greater loss of fat in the skim-milk. Ten revolutions per minute too slow increased the loss of fat 0.1 per cent.

TABLE III.—Showing the effect of Low Speed and Low Temperature Combined on the Percentage of Fat in the Cream and Loss of Fat in the Skim-milk. Three Runs were made from the same Milk on Three different Days.

Per Cent Fat in Milk.	Speed turned per minute.	Temperature of Milk.	Per Cent Fat in Cream.	Per Cent Fat in Skim-milk.
3.6	50	70 degrees.	28.5	.078
3.6	50	80 "	27.0	.083
3.6	50	90 "	21.5	.030

There is not as great a variation in the percentage fat in the cream as in some of the other tables, but the loss of fat in the skim-milk is very high at the low temperatures, showing that the best results will be obtained by turning the separator at its proper speed and having the milk at a temperature of 95 or 96 degrees.

Two runs were made from milk testing 3.3 per cent and two from milk testing 4.5 per cent. The following table shows the average results:—

TABLE IV.—Variation in the per cent Fat in the Cream from Milk containing different percentages of Fat.

Speed of Separator.	Temp. of Milk.	Per cent Fat in Milk.	Per cent Fat in Cream.	Per cent Fat in Skim-milk.
60	95.5	3.3	27.0	.017
60	95.5	4.5	35.5	.015

Here we find a difference of 1.2 per cent of fat in the milk made a difference of 8.5 per cent in the cream test. There will not be so much variation as 1.2 per cent fat in the milk from the same herd from day to day, but there may be a difference 0.5 per cent, which at the same rate of variation would equal 3.5 per cent in the test of the cream.

The foregoing results show very plainly that different conditions in the milk and only slight changes in the operating of the separator, without changing the cream screw, will make wide variations in the percentage of fat in the cream. If the temperature of the milk is too low, or the speed of the separator is reduced below the required number of revolutions per minute, the variations will be accompanied by an excessive loss of fat in the skim-milk.

A good separator, properly handled, will deliver cream testing anywhere from 20 to 35 per cent fat and not leave over 0.02 per cent fat in the skim-milk.

To give the best results in butter-making cream should test 30 to 35 per cent fat.

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